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EPINET
Knowledge Assessment Methodology

Smart Grids and Wearable Sensors

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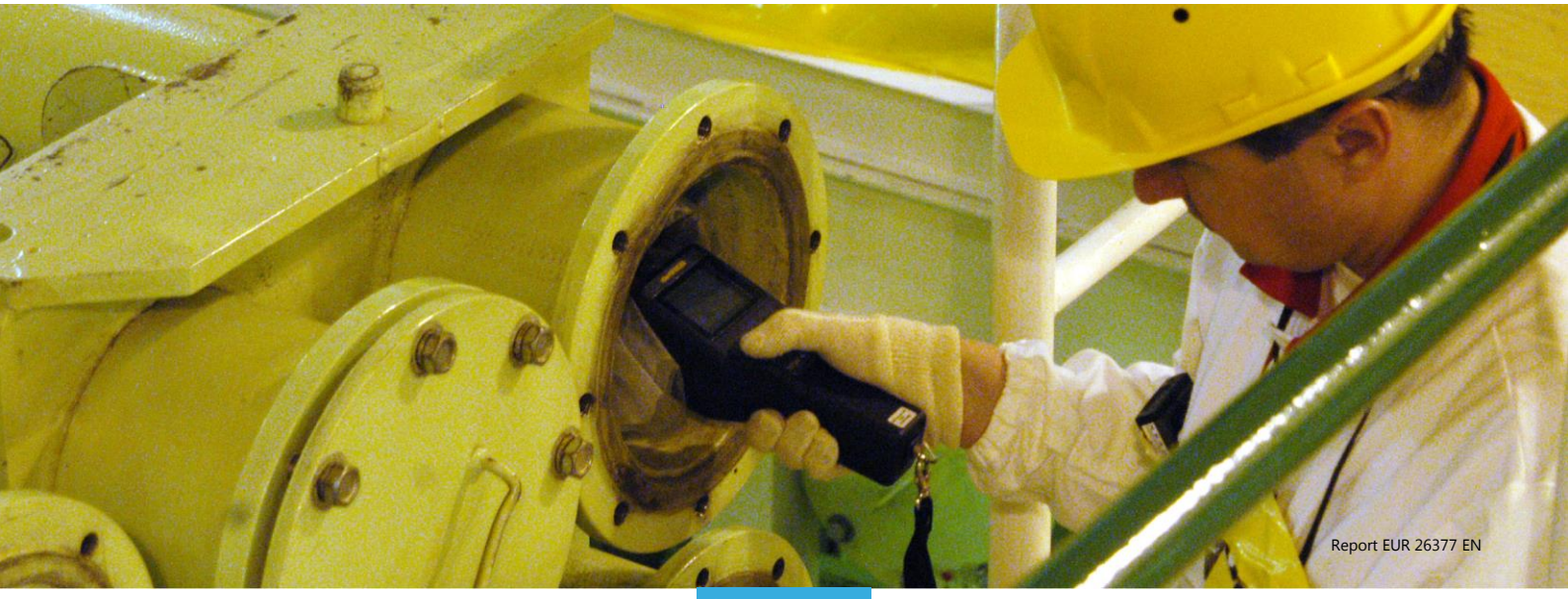

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Introduction

The EPINET project is an FP7 project. It represents the integrated assessment of societal impacts of new technologies within epistemic networks (http://www.epinet.no/#/EpinetProject). Its main objectives are to provide assessment of new and emerging technologies, guidelines for good governance in the context of EU policies and recommendations for the improved integration of technology assessment methodologies, and consequently to support a socially stronger and sustainable development of technology. In order to do this, the project looks at several cases of on-going technological development in Europe namely Smart Grids, Wearable Sensors, Robotics and In Vitro Meat.

The specific focus of JRC as a partner in the project is on the quality of knowledge produced around these technologies and used by policy makers and other stakeholders. We are looking at narratives coming from the policy sphere, industry and other actors in order to assess the quality of claims produced. Besides using knowledge assessment methodology for analysing policy papers and similar documents, we are conducting interviews with stakeholders in the field, that help us deepening issues from knowledge assessment, such as motivations and reasoning behind adopting particular views or evidence about this issue. We are looking at rhetoric around new technologies and worldviews enacted through such rhetoric. Consequently we will also identify key stakeholders and players in each case study.

In this report, we will first explain the Knowledge Assessment Methodology and then explore its application on an EC policy document about Smart Grids, as well as a commercial product such as Fitbit, an example of wearable sensors. These two parts are also used in two joint papers written jointly with the other EPINET partners, as well as the Deliverable 8.4 of the EPINET project.

Knowledge Assessment

Knowledge assessment is a systematic approach to the evaluation of fitness for function of knowledge inputs in decision-making processes. “Knowledge” here is not limited to “scientific knowledge”, but includes other types of knowledge created in spheres of life and experience other than the techno-scientific one. As a result, a new conception of knowledge is emerging, based on a new enriched awareness of complexity, in which a plurality of legitimate perspectives is acknowledged and appreciated (Funtowicz 2006). One can say that a new conception of knowledge appears to be emerging, based on a new enriched awareness of complexity, in which a plurality of legitimate perspectives is taken for granted (Funtowicz, *idem;* Ravetz*, xxx*). In this context, the quality control in research science cannot be applied. The evaluation of quality of knowledge in terms of fitness for purpose (quality being a relational attribute) is the core of knowledge assessment activities. The criteria and tasks of quality assurance must explicitly involve additional values and interests brought by the other spheres of knowledge production, as well as the explicit recognition that policy relevant science implicitly resonates with specific worldviews and value commitments that may include ontological commitments of groups other than scientists. This new configuration has been termed “post-normal science” (Funtowicz and Ravetz, 1990) and is the basis of a new conception of knowledge assessment.

Quality assurance is a core commitment of post-normal science, being organised through "extended peer review", engaging "extended peer communities", which include all those affected by a particular policy proposal or development where science is an input. Through our work on knowledge assessment over the years we found useful to base such quality assessment of policy relevant science on the concept of "pedigree" – one of the NUSAP categories (Funtowicz and Ravetz, 1990); with "pedigree" evaluations we look at the genealogy of the knowledge perpetuated in the stories told by social actors whose narratives invoke techno-scientific claims or other authoritative arguments. The concept of "pedigree", the "P" in the NUSAP acronym, was initially conceived for *quantitative* information but Corral Quintana (2000) has extended this concept to qualitative information proposing several categories to assess the quality of qualitative assertions used to formulate policies or to support decision-making. This extension has been applied to contexts of foresight, technology development and environmental policy making (GP, 2007), most of the times in participatory ways, i.e. involving the relevant extended peer community.

Methodology

In order to implement knowledge assessment, public narrations coming both from the policy sphere and promoters of a specific technology (in the case of smart grids: industry, energy agencies and other actors) in order to assess the quality of such claims. This will be done through a matrix of quality of information categories that is implied in the framings, factual or imagined argumentation, justifications, promises, motivations, appeals to the public and other narrative elements of the stories told in those public narrations. By identifying relevant narrations for the case of "smart grids", we also aim at identifying key policy and corporate players including technology developers or businesses, agencies, or other forms of organisation that interest (with vested interests) the case study.

Categories of quality

In order to look into information pedigree, a preliminary set of categories of quality that will be used to look at the narratives about smart grids as told in policy documents and corporate documents is presented in the table below.

Fitness for purpose (and fitness for function)	**Adequacy**:	By adequacy, it is meant the specificity of correspondence between the issue addressed and the information used – including exposition of controversies based on the available scientific knowledge, as well as ethical and legal arguments.
	Relevance:	Evaluates the relevance of the information invoked in the narrative in relation to the case study (how the available information corresponds to the relevant issue)
	Accuracy:	Transparency with which uncertainty and information gaps are exposed.
	Comprehensiveness/ completeness:	Level of incompleteness of information, e.g. data series or aspects of the process in which data or the results of their elaboration/processing are not controlled (or controllable), or are even incomplete.
	Applicability	This is another defining category of quality, which looks at the conditions with which information invoked in the narratives is made available and accessible. The following

		attributes are considered here: Accessibility and Intelligibility.
Reliability	**Control**:	this includes looking at the following criteria: o *Sources of information* – including the generation process for both methods and the actors involved; o *Verification* - The source of the information is as relevant as whether that information has been checked. It ranges from an external control considered as assuring a greater reliability, to situations in which such control does not exist or it is unknown (none); o *Colleague consensus* - It reflects the level of controversy in the scientific sphere, i.e. the degree of acceptance of the information by the rest of the researchers working in the same field.
	Confidence	o *Extended peer acceptance*: It reflects the level of controversy (or acceptance) of information used in spheres other than the scientific one, i.e. the degree of acceptance of the information by the rest of the actors within the same sphere of knowledge production. o *Legitimacy*: specifies the legitimising framework of the information. In so many cases the credibility of the information is closely related to the Institution that generates or sanctions it.

Proof of concept by illustration study: Looking at a policy document
In order to pursue knowledge assessment we looked at textual narratives that are made available publicly by policy and "promoters" spheres about smart grids. Hence, the main media source of documents that will be used here will be the Internet.

Results

a. SMART GRIDS

As way of example the 2011 Communication from European Commission on Smart Grids: from innovation to deployment is selected. Quotes are extracted from that text in order to illustrate the application of this methodology, which will serve as a first proof of concept. Once the tool is operational we will explore how it can be embedded in the daily practices of assessment of the epistemic networks around smart grid innovations.
The results are structured according to the type of claims they represent and references they use or do not use. For a pedigree assessment, references are important since they give the credential to

the text provided. However, there are many claims and assumptions made that are not supported by any reference. Similarly, many sentences are supported by the material produced by the same institution or organization close to and financed by the same institution.

1. No references

Large sections of the text of this document consist of assumptions, not supported by any reference. It makes a series of claims and does not make any reference to any body of knowledge.
"*Without serious upgrading of existing grids and metering, renewable energy generation will be put on hold, security of the networks will be compromised, opportunities for energy saving and energy efficiency will be missed, and the internal energy market will develop at a much slower pace*" (p.2).

Strong claims are made in this Commission's Communication that should be supported by relevant literature or at least explained with greater detail. Citizens without expertise in the field of renewable energy need to be able to understand why without the "serious upgrading" the "renewable energy generation will be put on hold". Similarly, it is stated that "the benefits of Smart Grids are widely acknowledged"(p.2), without providing any reference that would confirm this claim. When the Communication states that "Smart Grids will be the backbone of the future decarbonised power system" (p.2), it is not clear why the future power system will need smart grids as its backbone.
Claim:
"*Smart Grids are expected to generate new jobs and bring additional economic growth*", p. 4

which comes with footnote:

> *The low-carbon energy industry has to date generated 1.4 million jobs in Europe. Research in the USA has indicated that that up to 280 000 new direct jobs could be created in the USA by Smart Grids deployment, with more than 140 000 direct jobs retained beyond the deployment phase.*

has also raised our attention. Similarly to the previous quote, such claims should be better referenced where these numbers come from and what assumptions are made to craft them.

2. Zooming and omitting

> "*the Commission has set up a Smart Grids Task Force which has issued a report outlining expected services, functionalities and benefits. These are largely agreed by industry, public authorities and consumer organizations and are described in the attached Staff Working Paper.* "p.2

The aforementioned report by the Smart Grids Task Force is not referenced. Also it is not stated here what kind of services, functionalities and benefits are expected. The terms "services, functionalities and benefits" give the impression that the report states positive effects of smart grids even though negative aspects might be mentioned as well.
In this paragraph three industrial partners, one public authority and one consumer organization are mentioned. Eurelectric (http://www.eurelectric.org/about-us/), Orgalime (http://www.orgalime.org/page/about-us) and Geode (http://www.geode-eu.org/index.php) are the industrial partners. Eurelectric is a union that represents the interests of its over 30 full members of the electricity industry in Europe (f.e. Energy UK, Bundesverband der Energie und Wasserwirtschaft e.V., Union française de l'Electricité) at pan-European level and abroad. Orgalime represents the interests of the European mechanical, electrical, electronic and metal articles industry at the

European Union level. The members of Orgalime are the voice of 130.000 companies (mostly small and medium sized enterprises). Geode represents public and private companies located in 15 European countries who distribute gas or electricity (in total 1200 companies). Its aim is to influence policies and regulations at national and international level. A special work group deals with the issue of smart grids.
Moreover, the consumer organisation referred to in the quote above is ANEC (http://www.anec.org/attachments/ANEC-PT-2010-AHSMG-005final.pdf). Its objective is to increase standardization within the European Union. It is an international non-profit organization funded by the European CommissionUnion (95%) and EFTA (5%). Because of the funding situation it is closely linked to the European Union.
The document was jointly produced with BEUC -The European Consumer Organization (http://www.anec.org/anec.asp?p=about-anec&ref=01-01), which consists of 40 national consumer organizations from 30 European countries.

3. What gets voiced?

> "*With the transition towards smart energy systems come new opportunities for EU citizens, but as with any new technology, increasingly sophisticated functionalities can result in unintended consequences. Great emphasis is given by European policy-makers to the need to implement more active transmission and distribution systems. Central to the future development of this smart energy system is nevertheless consumer acceptance through enhanced consumer protection and empowerment. Effective regulatory and policy measures to address personal data handling, safety and consumer protection are, in our views, still lacking*." Page 7

The position paper mentioned earlier by the two consumer organisations mentions possible "unintended consequences" of new technologies like smart grids, as well as risks and privacy concerns. These uncertainties are not mentioned in the COM document where the reference is used to support the claim of the universal agreement on benefits of smart grids.
None of these concerns permeate the COM. It should be noted that the paper does not question the whole concept of smart energy systems but rather the way in which such new technologies could be implemented and regulated in order to ensure fair conditions for users.

4. Self-referencing (loops)

There are several ways in which self-referencing happens, in particular through referencing other documents produced by European institutions, such as:

> "*the deployment of Smart Grids provides an opportunity to boost the future competitiveness and worldwide technological leadership of EU technology providers such as the electrical and electronic engineering industry, consisting mostly of SMEs"* REFERENCE provided: ELECTRA COM (2009) 594 final.

Or through homemade rhetoric:

> "**The EU2020 agenda comes across with a clear message for Europe**. The EU's future economic growth and jobs will increasingly have to come from innovation in products and services for Europe's citizens and businesses. Innovation will also contribute to tackling one of the most critical challenges Europe is facing today, **namely ensuring the efficient and sustainable use of natural resources**."

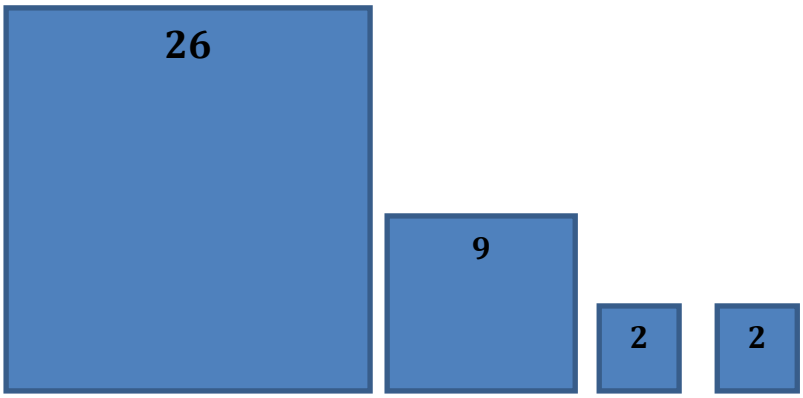
So, the grand challenge as depicted in the EU 2020 frames the whole proposal. Grand challenges are appropriated and encapsulated by EU documents as if these were the only arguments these grand proposals (i.e. .smart grids as cure for sustainable use of natural resources) can only be justified in rhetorical grounds.

5. Convenient truths

> *"the Commission has set up a Smart Grids Task Force which has issued a report outlining expected services, functionalities and benefits. These are largely agreed by industry, public authorities and consumer organizations and are described in the attached Staff Working Paper. " reflecting interest groups…*

Referencing industry and business in this case seems to be highly relevant. However, when reading the reports produced by the associations referred to information available is not peer reviewed and the knowledge generation process is far from being documented. A great deal of self-reference is making.

6. Pedigree



26 documents originate from the European Commission
9 from Industry
2 from consumer associations
2 from professional consultancies

b. WEARABLE SENSORS

As an example, we have used Fitbit, a health related consumer electronics device that has been on the market since 2008. It has a customer base and can be observed in action. It monitors a small range of activities linked to weight loss and fitness activity. It has proved a useful object to think with, offering both technology assessment researchers and technology makers two angles: an early indication of an emergent self-monitoring medical market; continuity with the existing consumer electronics market. FitBit seems to invite the user to explore and create a story about their own body – and to represent this body back to themselves through the interface. This user story is complemented by weblogs written by platform owners, and by the stories about the device which

are circulated in the media (news, tech reviews). In this section, we examine such stories by focusing on FitBit blog.
The Fitbit blog is a considerably developed part of the Fitbit website, with several pages/sections in which blog posts are classified.
Blog posts are divided into several categories: development (where possible future developments are discussed), general (with more general topics), health info (where blog posts explain why the use of FitBit is good for health), press and awards (blog posts about a conference where FitBit was presented and a prize a product got on another occasion) and uncategorized (where blog posts with no clearly classifiable content - except for advertisement - are placed).
While analysing the Fitbit blog, several issues sparked our interest, as they are relevant from a knowledge assessment perspective: problematic authorship, authors as knowledgeable individuals in the field of technology, friendship appeals to attract users, use of pseudo-scientific references to justify the application of the device.
Every blog entry is signed by its author, under the title - before the text - and also at the bottom of the article. That creates some confusion as to who actually is writing these blog entries because, while all the blog entries are at the bottom signed by Fitbit team, different pseudonyms (e.g. bazzarelli, Iking, syuen, etc.) are used at the beginning of the text. At the same time, everything is written in the first person of plural (which also facilitates the connection between users and producers). Because of this and since the pseudonyms are not revealed, it remains unclear who the actual writers of these blog posts are. Consequently, it is difficult to discover who produced the knowledge presented to Fitbit users and general public/readers. The use of "we" is in itself interesting, as implying representativeness, collective position that cannot be ascertained. According to Moniere (2007), the use of the pronoun "we" represents not only the blogger but everyone who surrounds him. It can be used in an exclusive way, so that it represents a certain group of people, like the producers, or to include the public as well (Myers, 2010). In this example, the author's will for including broader audiences in the discourse is quite clear. This kind of discourse makes the readers closer to the author and to the blogger who gets the impression they are directly spoken to (Vesnic-Alujevic, 2011).
The first category of blog posts, development blogs, serves to announce and advertise new products and applications. Their goal is also to present blog authors as knowledgeable individuals who work in the company. Claims that are made here are mostly unjustified. Many of them are linked to possibilities to be healthier, lead healthy life and lose weight, which are the current imaginaries of healthy living of a large part of the world population. For example, this quote illustrates the observation above:

> It's about reaching your goals in the most efficient and fun way possible. And it's about becoming as healthy as you want to be (Iking, 3 October 2011).

However, what "healthy" means for the individual is not really explained.
In the blogs general section, the success of Fitbit is presented first, but also an appeal to users to engage in developing the Fitbit "community" is presented as a need. Users are presented as key actors for the future of the device itself, programs created for it, etc.

> We're still fine-tuning and growing this beta program, but by joining now you can help develop our community and determine its future! (Iking, 15 March 2013)

They go further and use emotional appeal trying to encourage the development of feelings and emotional closeness towards the device, by using statements such as: "Flex™ is your perfect companion." In here, companionship is transposed to an object and becomes one of its features. This sort of artificial "pet" type of relationship is not new. For example, with the Japanese game virtual pet "tamagotchi" this was largely experimented. Yet, a great deal of changes have been

brought to “relationships” with progressive virtualisation of ordinary sentiments and peer to peer relationships, and the “perfect companion” and companionship can now be attributable to a hybrid world of human or other animals and inanimate objects in that traditional sense.
The third section, health info, should provide more information on health issues related to the use of Fitbit:

> Fitbit is dedicated to helping people lead healthier, more active lives. We take a common sense approach to fitness, and believe that the key is to make it easier for consumers to be more active, eat smarter, and get enough sleep — in short, that small changes to your daily routine can add up to big results.

This quote suggests that all these health benefits can be obtained through communication with the “companion” objects, explicitly giving these objects some type of agency. Also in this section, for instance, they stress that Fitbit devices help consumers to live a healthier life, suggesting several actions, such as, climbing 10.000 steps a day, sleeping 8 hours, drinking enough water, as well as monitoring blood glucose levels, even if none of these issues require the use of Fitbit. In their blog posts, participants refer to medical authorities, experts and doctors to support their health imaginary. Yet these references should be taken with caution, because it is not clear who those experts are and their authority in this field. One of the expert organisations they refer to is the American Heart Association:

> The American Heart Association uses the 10,000 step metric as a guideline to follow for improving health and decreasing risk of heart disease, the number one killer of men and women in America.

However, checking further this recommendation as well as the organisation itself, we observe that the recommendation for climbing 10,000 steps was “established” by journalists (on another website referred to at AHA) in order to make women become fitter and healthier. Moreover, the association is not an organisation of scientific experts, but rather an advocacy group that claims to be a “national voluntary health agency to help reduce disability and death from cardiovascular diseases and stroke”. Similarly, we found references to other organisations or experts, without knowing how knowledgeable (in a scientific sense), about the subject they really are. Here we can rather talk of knowledge co-production of claims and imaginaries about healthy lifestyle, fitness, etc.
We would argue, that what lacks in all groups, is a reasoned explanation and justification on why those products should be used.

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Abstract
This report presents our role and work in the joint FP7 project called EPINET. At the beginning, we explain the Knowledge Assessment Methodology, a fundamental approach and methodology we use in the project. Then we explore its application for the analysis of two cases on new technologies in Europe: first while analysing an EC policy document about Smart Grids, and then analysing the official blog of Fitbit, a company that produces a wearable sensor used for fitness purposes. These two parts of the Results section are also used in two joint papers written jointly with the other EPINET partners, as well as the Deliverable 8.4 of the EPINET project.

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As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle. Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

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